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Key and Best Practice to Integrate and Access the Various Sources of Uncertainty on 'Geomodelling'

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Abstract

Nowadays, a digital 3D geological model becomes a compulsory component for the entire project management which is normally required from the government and partners. The reservoir model consists of (1) the structural model (faults and horizons), (2) fluid contact, (3) depositional (facies) model, (4) petrophysical (porosity and permeability) model, (5) fluid (saturation of water) model, and (6) pressure/volume/temperature (PVT) model describing formation volume factors and solution-gas ratios. With these all model elements; each one carries their own uncertainties.

A general workflow of static model generally consists of the structural framework and 3D geocellular construction, following with facies and property modelling by an effort to optimally capture all geological attributes. Good quality 3D seismic data allows recognition of subtle faults and sedimentary structures directly. However, often the structural interpretation from unclear seismic data contain high uncertainty in both fault and horizon interpretation. Those will produce high uncertainty in horizon modelling and with combination of fluid contact will be the most significant uncertainty variable: the gross rock volume (GRV).

A model may be a conceptual representation of the architecture of genetic bodies within which petrophysical variation can later be distributed. If geological models are used for dynamic simulation, they must be generated in three dimensions; the two-dimensional models could not provide a realistic representation of reservoir connectivity. Building the reservoir connectivity can be done thru facies modelling. There are two most common approaches (Figure 1) in facies modelling: (1) Object-based and (2) Pixel-based. The object models use the information about the shape, size and relative position of the sand bodies, whereas indicator simulations are constraint by an input variogram model.